

Technical Memorandum

To: Erling Westlien
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CC:

From: Alam Mohammed, Fluid Dynamix

Date: 9/11/2013

Re: Burger Field: Current Speed, Temperature and Salinity

Temperature and Salinity

The observed temperature and salinity data reported in "PHYSICAL OCEANOGRAPHIC MEASUREMENTS IN THE KLONDIKE AND BURGER SURVEY AREAS OF THE CHUKCHI SEA: 2008 AND 2009" (Figure 13, Weingartner and Danielson, 2010) for the year 2008 is presented in Table 1 for Burger Field. Table 1 also presents the data used in the OOC model to enable a comparison against the observed data.

In the OOC model for the Burger Field: the temperature of the ambient water varies from 4 degrees Celsius (°C) at the surface stratum to - 0.5 °C at the bottom stratum, with a significant stratification occurring at 15 m depth. The salinity of the ambient water varies from 30 Practical Salinity Scale Unit (psu) at the surface stratum to 32 psu at the bottom stratum. These temperature and salinity data are in close agreements to those reported for the year 2008. **For the purpose of the sensitivity analyses: 2.0 °C and 29.5 psu at the surface stratum can be used as the low end value. Whereas, -1.5 °C and 33.0 psu can be used at the bottom stratum.**

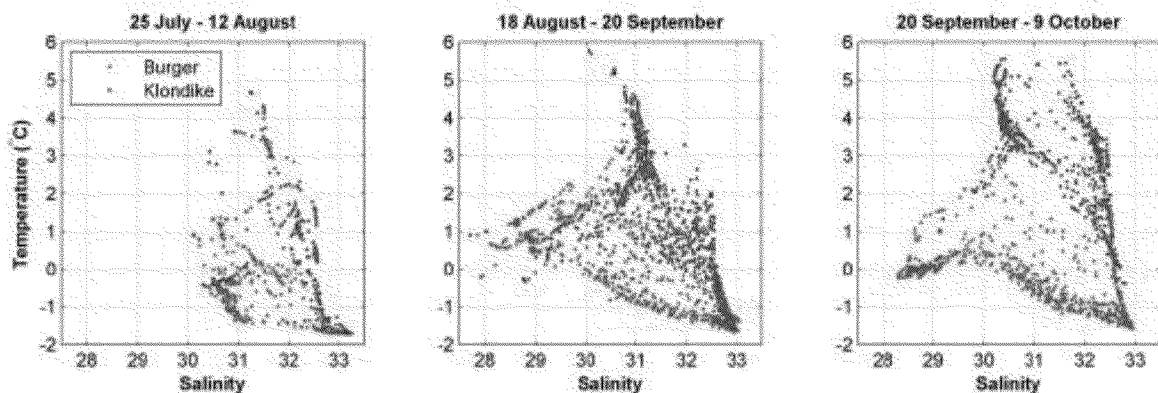


Figure 13. Temperature-salinity diagrams for each survey conducted in 2008.

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Table 1: Burger Field – Temperature and Salinity

25 July - 12 August		18 August - 20 September		20 September - 9 October		Data Used in the Model	
Temperature (C)	Salinity (psu)	Temperature (C)	Salinity (psu)	Temperature (C)	Salinity (psu)	Temperature (C)	Salinity (psu)
3	n/a	3	30.5	3	30.5	4	30
2	n/a	2	29.5 - 30.5	2	29.5 - 30.5	3.5	30.5
1	30 - 31	1	27.5 - 31	1	28.5-32.5		
0	30.5 - 32	0	28 - 32.5	0	28.5-32.5	-0.25	31.5
-1	31 - 32.5	-1	31-32	-1	31.5-32.5	-0.5	32
-1.5	31.5 - 33.5	-1.5	33	-1.5	33		

Current Speed

The Technical Memorandum “Results from Chukchi/Beaufort Seas Permit Dilution Modeling Scenarios”, prepared by Tetra Tech for US EPA Region 10, dated October, 2012 has used the current speeds : 2, 10, 20, 30, and 40 cm/s.

The report “PHYSICAL OCEANOGRAPHIC MEASUREMENTS IN THE KLONDIKE AND BURGER SURVEY AREAS OF THE CHUKCHI SEA: 2008 AND 2009” (Figures 2 and 3, Weingartner and Danielson, 2010) for the year 2008 states the following: Mean current speeds within the Herald and Barrow canyons are swift (25 cm/s), more moderate in the Central Channel (10 cm/s), and generally <5 cm/s elsewhere. **Table 2** presents the coordinates for the wells located in the Burger Field. All prospect wells are located in 71° N and 163° W. It can be seen from **Figure 3** that the mean flow vectors (blue arrows) in the vicinity of 71° N and 163° W are approximately in the range of 3 cm/s to 10 cm/s.

Table 2: Location of the wells in the Burger Field

Prospect Well	Area	Block	Coordinates (m)	
			Latitude	Longitude
Burger A	Posey	6764	N71° 18' 30.92"	W163° 12' 43.17"
Burger J	Posey	6912	N71° 10' 24.03"	W163° 28' 18.52"
Burger V	Posey	6915	N71° 10' 33.39"	W163° 04' 21.23"
Burger F	Posey	6714	N71° 20' 13.96"	W163° 12' 21.75"
Burger R	Posey	6812	N71° 16' 06.57"	W163° 30' 39.44"
Burger S	Posey	6762	N71° 19' 25.79"	W163° 28' 40.84"

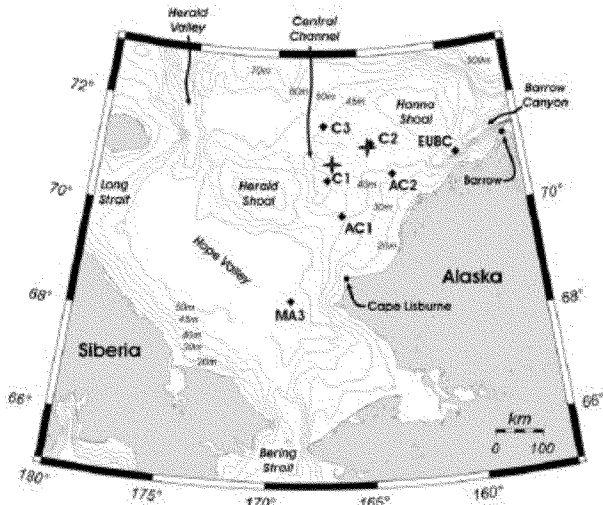


Figure 2. Bathymetric map of the Chukchi Sea shelf showing the Herald Valley, Central Channel, Barrow Canyon and two prominent shoals: Herald and Hanna. Also shown are the locations of current meter moorings deployed from 1994-1995. The blue stars are the approximate locations of the Klondike and Burger leases.

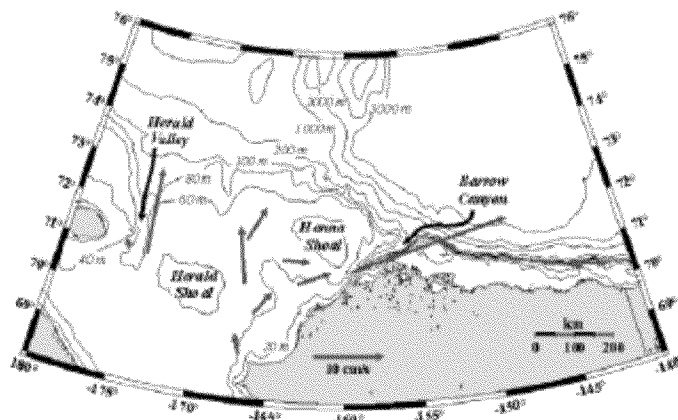


Figure 3. Mean flow vectors (blue arrows) from moorings deployed in the Chukchi Sea and Beaufort slope deployed between 1990-1995 and with record lengths exceeding 9 months.

Recommendations

The current speeds of 20, 30, or 40 cm/sec used by Tetra Tech are not applicable to the Burger Field. **For the purpose of the sensitivity analyses: 3 cm/sec as the low end value and 10 cm/sec (or 15 cm/sec) as the high end value can be used.** The current speed of 7 cm/sec used in the model served as the mean value. In the OOC model for the Burger Field, the current speed of 7 cm/sec stays uniform throughout the depth of water, which is approximately 43.9-45.7 m. We could vary the current speed with depth if there are data available to support this approach; otherwise we use same value for the entire depth of water. **These recommendations are based on the data cited in this TM.**

References

Weingartner, T. and S. Danielson. 2010. Physical oceanographic measurements in the Klondike and Burger prospects of the Chukchi Sea: 2008 and 2009.